

Remarks

Attached hereto are AMENDED CLAIMS. Claim 1, 12, 23 and 26 have been amended by specifying the Group VIII metal component to be selected from the group consisting of nickel, cobalt and iron. Support for this amendment may be found on page 7, lines 17 and 18 of the instant text.

Response to amendment

Applicants note with appreciation that the Examiner has withdrawn the rejection under 35 USC 103(a) over Gerritsen in view of the several Takahashi references.

Rejection under 35 USC 103(a)

Claims 1, 7-12 and 18-28 stand rejected over Hatanaka et al. in view of any one of the three Takahashi references. The Examiner's position is that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Hatanaka by using the catalyst of Takahashi because Takahashi discloses that the catalyst is less expensive, simple to prepare and shows higher activity in hydrodesulfurization.

Considering first the teachings of Takahashi U.S. 4,845,068. All examples in this reference deal with a feedstock having a sulfur content of 1.61 percent. The degree of desulfurization is reported as the "desulfurization rate", which is the percentage of sulfur that is removed from the feedstock. The highest desulfurization rate is 93.5 percent, which means that 6.5 percent of the original

sulfur content remained. This is about 0.10 percent, which equals 1000 ppm. The disclosures of Takahashi EP 0 289 211 appear to be identical to those of U.S.' 068.

The disclosures of EP 0 357 295 appear similar to those of U.S.' 068. The examples in this reference report on the hydrodesulfurization of a feedstock containing 1.13 percent sulfur. Up to 87 percent of the sulfur is removed, leaving about 1500 ppm. Clearly, the Takahashi references do not deal with ultra-deep hydrodesulfurization.

The Hatanaka reference discloses a single step hydrodesulfurization of a sulfur-containing feedstock in a reactor having three reaction zones. Different hydrotreatment catalysts are present in each zone. The catalyst in the first zone consists essentially of cobalt and molybdenum, supported on a porous carrier containing alumina as a main ingredient. The catalyst in the second hydrogenation zone consists essentially of nickel and tungsten supported on a porous carrier containing 85 to 99 weight percent of alumina or amorphous silica/alumina and 1 to 15 weight percent of zeolite. The catalyst in the third hydrogenation zone consists essentially of cobalt and/or nickel, and molybdenum, supported on a porous carrier containing alumina as a main ingredient.

The feedstock used in the Hatanaka reference has a sulfur content of, for example, 1.53 weight percent that is reduced to 240 ppm (Ex. 1); 230 ppm (Ex. 2); and 30 ppm (Ex. 3), respectively.

The skilled person would not have had any incentive to replace the catalyst systems of Hatanaka with those of the Takahashi references. The statement in EP 0 357 295 that the claimed catalysts “can be prepared more simply and more inexpensively” was with reference to the prior art discussed in the previous section of this reference. There is no indication whatsoever that this statement would apply to the catalysts of Hatanaka, because this reference came more than ten years later. No one reading the Takahashi reference would conclude that the catalysts disclosed therein are better or more inexpensive than those of Hatanaka.

Even if the teachings of these references could be combined, such combination does not lead to the process of the present invention. The Hatanaka reference deals with three different catalysts, each used in a different zone in the reactor. The Takahashi references deal with the desulfurization of a feedstock having between 1 and 2 wt. percent sulfur. This is the situation in the first reaction zone of the Hatanaka process. Therefore, the combination of the two references, if it could be made, might lead one to replace the catalyst in the first zone of the reactor with one disclosed by Takahashi.

There is no logical basis for replacing the catalysts in the other two zones with those of the Takahashi references, because Takahashi does not in any way suggest that these catalysts might be suitable for ultra-deep hydrodesulfurization. Replacing the catalyst in the second zone also with a Takahashi catalyst would in essence reduce the Hatanaka process to a two-zone process, and replacing all three catalysts with a Takahashi catalyst would modify the Hatanaka process to a single-zone process. It is an essential feature of the Hatanaka process that it is a

three-zone process. Therefore these substitutions cannot be reasonably deduced from a combination of this reference with Takahashi.

The process presently claimed is specifically limited to contacting the feedstock with a one or two step process, but in all of the instant claims the actual ultra-deep hydrodesulfurization is achieved in a single zone with a single catalyst. The process disclosed in the Hatanaka reference requires two zones and two catalysts for ultra-deep hydrodesulfurization, with desulfurization activity for dibenzothiophenes not occurring until the second zone. Thus, Hatanaka could not possibly lead to the process of the present invention with its one ultra-deep hydrodesulfurization zone, either by itself or in any combination with the Takahashi references.

Claims 1, 7 to 12 and 18 to 28 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Baird et al. (5,935,420) in view of any of the Takahashi references.

The Baird reference recognizes that certain derivatives of dibenzothiophene, especially those mono- and di- substituted and condensed ring dibenzothiophenes bearing substituents on the carbons beta to the sulfur atom are extremely difficult to remove from a hydrocarbon feedstock. The reference refers to these thiophenes as "hard sulfur". In the background section the reference discusses the failure of traditional cobalt/molybdenum and nickel/molybdenum catalysts to reduce sulfur levels to the extent required for modern fuels. The reference discloses a new process involving the use of a supported noble metal catalyst, wherein the noble metal is selected from the

group consisting of platinum, palladium, iridium, and rhodium. The reference therefore teaches away from using the traditional cobalt/molybdenum or nickel/molybdenum catalysts.

Because of this teaching away, the skilled person would not be inclined to use the Takahashi catalysts in the process disclosed by Baird itself. Also, there is nothing in the Takahashi references suggesting that the catalysts disclosed therein would be capable of desulfurizing a feedstock to a level below 1000 ppm.

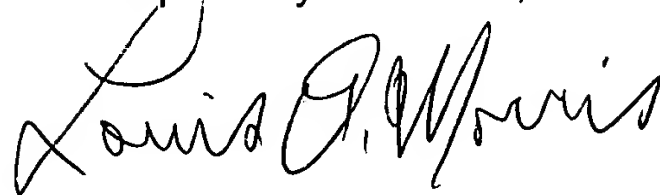
Even if such a substitution were made, it does not lead to the process of the present invention. The Baird et al. process is a two-stage process, comprising a catalytic conversion of sulfur compounds to hydrogen sulfide, followed by absorption of the hydrogen sulfide by, for example, zinc oxide. The process of the present invention comprises a single ultra-deep hydrodesulfurization step of contacting the hydrocarbon feed with a specifically selected catalyst, a catalyst not comprising the Group VIII noble metal required by Baird et al.

Conclusion

It is respectfully submitted that the references cannot be appropriately combined in the manner suggested by the examiner. Moreover, even if so combined they do not lead to the process as presently claimed.

It is respectfully requested that the instant claims be allowed and that the present application proceed to issue in due course.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Louis A. Morris". The signature is fluid and cursive, with the first name "Louis" being the most prominent part.

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